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Published in:
Livestock Science

DOI:
[10.1016/j.livprodsci.2004.08.010](https://doi.org/10.1016/j.livprodsci.2004.08.010)

Publication date:
2005

Document version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Gamborg, C., & Sandøe, P. (2005). Sustainability in farm animal breeding: a review. *Livestock Science*, 92(3), 221-231. <https://doi.org/10.1016/j.livprodsci.2004.08.010>

Sustainability in Farm Animal Breeding: A Review¹

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Abstract

The paper examines the notion of sustainable farm animal breeding. A brief explanation of why sustainability matters is offered first. After this, the historical development of the concept of sustainability is charted. The authors then turn to review published literature with a bearing on sustainable farm animal breeding. Little has been written directly on the subject: the requirements of sustainable farm animal breeding await serious clarification. The paper looks at SEFABAR (Sustainable European Farm Animal Breeding and Reproduction), a project designed to identify sustainable practices in farm animal breeding which ran for nearly three years from 2000. In this project commercial breeders and breeding scientists were required, with the professional assistance of bioethicists, economists, social scientists and NGO representatives, to develop a definition of sustainable farm animal breeding. The authors describe initial attempts to carry out this task. They then describe a general method of building a definition of sustainability — the so-called concern-criteria-indicators method — that was used in SEFABAR to good effect. They note the progress that was made once this method was introduced. Finally, the importance of communication is explained. The authors suggest that the concept of sustainability can be effectively used to organise and facilitate dialogue between stakeholders, including the breeding industry and society as a whole.

Keywords: farm animal breeding, communication, criteria, ethics, stakeholders, sustainability

¹ The reference of the printed version is:

C. Gamborg & P. Sandøe (2005): *Livestock Production Science*. Volume 92. Issue 3: 221-231

The definitive version is available at

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T9B-4DKH0SD-1&_user=10&_coverDate=03%2F01%2F2005&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1459176614&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=e947047e388711689360ca3b9cfb4c51&searchtype=a

1. Introduction

The topic of this paper is sustainable farm animal breeding and reproduction. Since farm animal breeding is a commercial activity, it might be suggested that breeders would be best advised to focus on business imperatives and need not detain themselves with questions about an issue like sustainability. Such questions, it might be added, can be left to politicians, officials and representatives of interest groups — that is, to those working in the formulation, implementation and maintenance of agricultural policy.

This attitude is understandable. However, we suggest that farm animal breeders have several good reasons to get involved in discussions about sustainability. First, there is no avoiding the fact that, in Europe and throughout the developed world, the concept of sustainability has come to occupy a prominent role in much present-day planning of the future of agricultural production as a whole. Clearly, farm animal breeders need to engage with this planning activity, but there is little chance of their doing this, still less of their influencing planning decisions, if they do not reflect carefully on the implications of sustainability for the breeding sector.

Second, twenty-first century consumers in the developed, food-rich world appear to have a real interest in foods produced in a sustainable way. Quite what features sustainably produced foods must have is debatable. It is also debatable what features consumers *take* sustainably produced foods to have. But there is no doubt that for many western consumers the word ‘sustainable’, like the more specific ‘biodegradable’ and ‘recyclable’, is positive enough to support a viable and growing niche-market in foods. Breeders would be unwise to ignore this social development.

Third, farm animal breeders are in effect *already* looking at sustainability-related traits. Functional traits affecting the health and welfare of future farm animals are increasingly important, as is the preservation of genetic resources for future use (Sandøe et al., 1999), and animal health and welfare, and the preservation of genetic resources, are elements of sustainability as it is understood today (Gamborg & Sandøe, 2003). The great advantage of putting sustainability in the foreground, as we explain at the end of the next section, is that it obliges decision-makers to combine elements like these in a *unified perspective*.

Responding to these developments, this paper examines key issues raised by the application of sustainability to farm animal breeding and reproduction. It does not pretend to offer fully worked-out answers to the questions it confronts. It attempts instead to clarify those questions, and then asks how the issues might be profitably addressed. *En route*, the paper describes a recent attempt within an EU-funded network project to identify ways in which breeding and reproduction can be more sustainable. This network, running under the title SEFABAR (Sustainable European Farm Animal Breeding and Reproduction), involved participants from industry, animal science, the social sciences, bioethics and special interest groups (Liinamo and Neeteson, 2001). The present authors participated in SEFABAR as experts in bioethics.

2. The Evolution of the Ideal of Sustainability

It is often said that there are countless definitions of sustainability. It is true that attempts to define sustainability involve innumerable *wordings*, but many of these wordings are alternative ways of saying the same thing. Unfortunately, this mixture of conceptual and merely nomenclatural variation can be rather bewildering.

The idea of sustainability has in fact evolved over hundreds of years and has come to encompass a growing number of concerns. In its earliest deployment, it was connected with the simple aim of maintaining renewable resources for harvest and consumption in perpetuity, i.e. sustained yield. This aim was first described systematically more than 350 years ago in connection with German forestry and mining. Over the next 200 years, the concept of sustained yield became, in different interpretations, something of a lodestar — in forestry especially, but also in fisheries and other primary industries involving the regular harvesting or extraction of a natural resource.

During the twentieth-century, the goals of sustainability came to include more than that of maintaining consumable resources such as fish, firewood and fodder. In the ‘Stockholm Declaration on the Human Environment’ resulting from the 1972 United Nations Conference on the Human Environment, and in the ‘World Conservation Strategy’ released in 1980 by the World Conservation Union (IUCN), sustainability was elaborated, beyond an anthropocentric concern with human livelihood, to cover the preservation of *species* and *ecosystems*. The seminal 1987 Brundtland commission report of 1987 shifted the focus to *distribution*, and in particular distribution across generations, the idea being that there should be no short-term privileges for the present generation (WCED, 1987). And following the Rio Declaration of 1992, fair *intra*-generational distribution between the developed and developing countries was treated as an element of sustainability.

As will be readily appreciated, by the late twentieth-century ‘sustainability’ had become a favourite buzzword of policy-makers (Bromley, 1998), a term under which more and more concerns were being promoted. In the agricultural sector, for example, matters as diverse as the provision of a good working environment, profit for farmers, and animal welfare came to be regarded as aspects of sustainable production. Some of these concerns would seem, to the average person, to lie at some distance from the core idea of sustainability. In policy circles, however, they had come to be regarded as indispensable components of sustainable development.

In essence, a process of *conceptual erosion* was underway (Dubgaard et al., 1999). Such erosion occurs when aims or objectives widely considered worthy of promotion are collected under a single heading (here ‘sustainable development’) in a way that allows the heading to be applied to a range of issues in various disciplines and sectors. Initially this can be rhetorically effective. It is indeed difficult *not* to be in favour of a development which allows an industry to prosper, gives a sustained yield of high quality products, protects the natural environment, caters for the needs of future generations, provides for the needs of poor people, takes care of animal welfare, and so on. The obvious problem, however, is that eroded concepts become harder and harder to deploy meaningfully as they incorporate a growing number of aims and aspirations. In particular, and most strikingly, it often becomes impossible to pursue the many ideals that fall under an eroded concept simultaneously.

There are broadly two ways to react to the erosion of the concept of sustainable development. Either the concept can be surrendered to the politicians and other decision-makers who wish to make largely rhetorical use of it, or it can be ‘braced up’ so that sustainability becomes an operational ideal once more (Dubgaard et al., 1999). The second option has been taken over the last ten years in natural resource economics. It has proved successful, and there is now much greater appreciation of the ethical assumptions, about such matters as distributive justice and the value of nature, that inform decisions in this field.

In short, then, the concept of sustainability has come to play a central role in developmental planning, both nationally, internationally, and within individual economic sectors. In the process, it has been eroded, but

there is nevertheless good reason to suppose that it can be applied productively in the farm animal breeding sector. Such deployment will have the great advantage of combining various concerns, in the planning process, in a unified perspective. However, if sustainability is to be invoked in efforts to shape the future of farm animal breeding and reproduction, the hard work will consist in adapting the general notion to the specific conditions, agendas and priorities that obtain in this sector.

A natural preliminary to any attempt to adapt sustainability in this way would be to examine published work on the implications of sustainability for livestock farming, or farming in general, looking especially for material relevant to farm animal breeding. It is to this task that we now turn.

3. The literature on sustainability in agriculture and livestock production

Agronomists and livestock specialists have displayed a serious interest in sustainability for some time now (see e.g. Alrøe and Kristensen, 2000; Broom, 2001; Francis, 1997; Heitschmidt et al., 1996; Hermans and Vereijken, 1994; Hindar, 1992; Svennevig et al., 1997; Pearse and Drew, 1998; Pimental et al., 1989; Thompson and Nardone, 1999; Viatte, 2001; Wit et al., 1995). It is worth asking to begin with whether the farm animal breeding and reproduction sector can learn any lessons from this work.

In these and other papers, sustainable systems are defined in a variety of ways. It has, for example, been said that sustainability involves balancing the needs of the current generation and those of future generations and securing what is biologically and physically achievable in the long run (Vavra, 1996). But it has also been stated that sustainable animal production has to satisfy a number of ethical, economic and ecological (i.e. environmental and biodiversity-related) conditions (Torp-Donner and Juga, 1997).

Again, commonly enlisted requirements of sustainable agriculture include resource efficiency, profitability, productivity, environmental soundness and social viability (Francis, 1997). And according to Olesen et al. (2000), 'sustainability' refers to the tenet that environmental concerns, genetic diversity, ethical considerations and social issues should be addressed as well as short-term and long-term economic value.

These papers do not address the specific requirements of sustainable farm animal breeding and reproduction. Using a +200-line database search string, we therefore conducted a systematic review of the literature on farm animal breeding and reproduction within Western Europe and the United States, looking for research either on sustainability as such or on sustainability-relevant issues such as animal health, productivity, genetic diversity (Gaworski et al., 2002). The review confirmed that there is a wealth of literature on concerns that fall under the general heading of sustainability, but that in this literature uneven attention is given to the relationship between these components and the general ideal of sustainability (e.g. Christensen, 1998a; Broom, 1998).

Few papers look directly at what sustainable farm animal breeding and reproduction would involve (some examples are: Amer et al., 1998; Brenøe and Torp-Donner, 1999; Hodges, 1991; Martyniuk and Planchenault, 1998; Olesen et al., 2000; Olesen et al., 1998; Stear et al., 2001; Torp-Donner and Juga, 1997). Fewer still examine sustainable breeding and reproduction in individual species (e.g. Kanis, 1993 (fish); Leenstra and Ehlhardt, 1994 (poultry meat); Olesen and Bentsen, 1999 (pigs)).

Some papers try to link the likely features of future agricultural systems to potential animal breeding strategies (Boettcher, 2001; Steverink et al., 1994). Others (e.g. Olesen et al., 2000) discuss the resolution of

conflicting concerns. Yet others consider the relationship of breeding goals to so-called non-market traits such as animal welfare (e.g. Olesen et al., 1999). However, these papers do not treat sustainability in a way that would provide breeders and other stakeholders in breeding and reproduction with very clear practical guidance.

It would appear, then, that within the breeding and reproduction sector there is a real need to define sustainability more clearly, and in more practical terms. A project set up to meet this need will now be described and evaluated. This project proceeded on the basis that the concept of sustainable farm animal breeding is best elaborated through consultation with breeders and other stakeholders in the industry. The present authors concur with this methodological assumption.

4. SEFABAR: A Network Project Defining Sustainability in Farm Animal Breeding and Reproduction

In 2000 the Farm Animal Industrial Platform — now the European Forum of Farm Animal Breeders (EFFAB) — initiated the SEFABAR network project in order to explore the implications of sustainable farm animal breeding. It was envisaged that SEFABAR would be a three-year project. It would therefore involve substantial and continuing input from a wide range of stakeholders, including commercial breeders, breeding scientists, bioethicists, economists, social scientists and NGO representatives. Consumer organisations would not be directly involved in the project, although they had been approached. However, the NGO representatives, from the German Animal Welfare Federation (Deutscher Tierschutzbund), would represent one consumer perspective.

4.1 Initial Attempts to Define Sustainability

Within SEFABAR, four working parties of breeders and breeding scientists were set up. The parties, which operated as ‘species groups’ focusing on ruminants, pigs, poultry and fish, respectively, were asked to construct definitions of sustainability. They were encouraged to characterise key concerns, to identify any resulting dilemmas and to assign priorities. They also attempted to formulate general definitions of sustainable farm animal breeding. In all this, the professional assistance of an ethics partner (the authors of this paper, and in the initial period Stine B. Christiansen) was available for consultation.

The species groups agreed on “Genetics for future use” as a general definition of sustainable farm animal breeding (Liinamo and Neeteson-van-Nieuwhoven, 2002: 24). Pretty clearly, this definition provides no real information about what is actually entailed in sustainable breeding and reproduction. In its nature, breeding always involves genetic change and is always future-directed, so any breeding activity would fall under a definition framed at this level of generality.

A more detailed definition, which emerged at an early stage in the work of one species group, was: “Produce animals that fit better into the environment for the production of good quality products for present and future generations in an acceptable manner” (Liinamo and Neeteson-van-Nieuwhoven, 2002: 15). While it is an improvement, this definition raises a number of serious interpretative questions. Does the phrase “fitting better into the environment” indicate more efficient use of resources, or the development of livestock better adapted to certain conditions, or something else? When we say “in an acceptable manner”, do we mean commercially acceptable, practically acceptable, or morally acceptable? Who is to be the judge of this?

4.2 The ‘Concern-Criteria-Indicators Method’

As a rule, the species groups’ attempts to come up with definitions followed a similar pattern. At first, cogent discussion of why a specific wording had been chosen was lacking. There was a certain amount of confusion about terms — such as ‘definition’, ‘principles’, ‘concerns’, ‘criteria’ and ‘indicators’ — that might be used in the defining process. As the work progressed, however, these terms were clarified; and as a result the participants came to see that there might be several layers (so to speak) in a definition, and that instead of trying to encompass everything in a comprehensive one-off phrase, they could profitably address underlying concerns separately.

As ethics partner to the project, and drawing on previous work on the handling sustainability in agriculture and natural resource management (Gamborg and Larsen, 2003), we suggested to the species groups that the basic definition of sustainable farm animal breeding and reproduction would be best broken down into key concerns, which could then be collapsed into more detailed criteria and indicators.

Concerns might include *animal welfare* and *production efficiency*. Roughly speaking, they are labels for general issues whose relevance, at least, would be accepted by most people.

Criteria, by contrast, are typically expressed by coupling a concern with a direction of change (e.g. to *maintain* productivity, to *decrease* use of resources or to *enhance* animal welfare). Alternatively, they can be presented in statements detailing desirable states, processes or qualities of the concern in question. Thus the statement ‘There is a specific policy in place on the breeding of dairy cattle which raises the following six points about animal welfare...’ introduces six criteria of animal welfare. Because they make more specific practical claims than concerns, criteria are likely to provoke debate. It is one thing to agree that animal welfare is relevant. It is quite another to assert, in the name of sustainability, that animal welfare needs to be enhanced. Some people will sincerely insist that the level of welfare presently enjoyed by farm animals is adequate.

Finally, indicators are empirically verifiable states of affairs that can be used to determine whether, and to what extent, a criterion is fulfilled. In essence, they allow us to measure the satisfaction of criteria, and thereby to assess the extent to which a concern has been met. Several indicators are normally connected with each criterion; their selection is essentially a technical matter.

Experience in other sectors suggests that, in most applications, the concept of sustainability needs to be broken down into 4-6 concerns, each of which should be assigned 2-4 criteria. Each criterion can be assessed on the basis of 2, and at most 4, indicators, depending on its inherent complexity. It can be seen, then, that if we were to start with one definition and 4 concerns, we might end up with 8-16 criteria and as many as 32-72 indicators.

Illuminating enquiries can of course be raised about the criteria and indicators. For example, are they closely and unambiguously related to one another and to the relevant concern? Are the indicators easy to detect, record and interpret? Do they continue to give you useful and meaningful information across a wide range of situations?

The method of concern-criteria-indicators has two highly desirable features that deserve emphasis. First, the grounding of concerns and criteria in checkable indicators permits effective follow-up monitoring of the extent to which an abstract ideal like sustainability is being secured. In effect, the indicators act as indexes of success.

Second, the method makes it easier to see that the concerns of sustainability will often *conflict* with one another — and to see why this is so. Initially, the SEFABAR breeders reflected very little on the fact that different concerns might clash. This was a mistake, albeit an understandable one. To state merely that breeders of broilers should have as prime concerns animal welfare, environment, quality and efficiency is to give no information about the extent to which efficiency is to be promoted, if necessary, at the cost of animal welfare. As the project proceeded, the breeders came to see that they would need to anticipate and negotiate trade-offs, and that these trade-offs would depend on value assumptions, i.e. the breeder's beliefs about the relative importance of potential breeding goals.

In saying this, we have no wish to downplay the importance of *technological* advances in resolving conflicts. Such advances might well make it possible, for example, to ensure that productivity — or profitability — is maintained without the level of animal welfare being lowered. In this vein, one of the species groups stated: “Pig breeding programmes can be designed such that no reduction in health (e.g. piglet vitality) and welfare (leg weakness) due to selection on increased production and reproduction... will occur” (Lianamo and Neeteson-van-Nieuwhoven, 2002: 29).

4.3 Later Attempts to Define Sustainability

This method of breaking down a definition is, then, an effective way of teasing apart, and revealing the relationships between, the concrete issues raised by an abstract ideal like sustainability. How effective was this approach in the SEFABAR project?

It is not hard to see that many of the most readily identifiable concerns about sustainable farm animal breeding and reproduction are essentially raised by livestock production *in general*. These concerns include animal welfare, health, animal integrity, biodiversity, environmental protection, consumer safety, food quality and global competitiveness. From this list, the SEFABAR species groups were asked to single out what they considered the most important concerns in relation to their species. The groups soon came to see that headings such as ‘animal welfare’ (Broom, 1991, 1998; Jensen and Sandøe, 1997; Appleby and Sandøe, 2002) and ‘food quality’ (Frewer et al., 2001) mean different things to different people and therefore needed to be unpacked. The method of concern-criteria-indicators was suggested for this purpose.

By the second year of the network the main concerns of sustainable farm animal breeding and reproduction had been agreed. Referring to these, the ethics partner then prepared a ‘checklist’ of questions. The list was designed to act as a prompt to the species groups — it required the groups to make connections between their general concerns with specific breeding goals. It contained five basic categories of enquiry. Together, these categories contained ten specific questions (see Figure 1).

What concept of sustainability is being used?	1. Idea or vision of sustainability 2. The kind of definition used
What is deliberately included/not included?	3. List of included concerns – and why <div style="display: flex; justify-content: space-between;"> <div> Productivity <input type="checkbox"/> Food/product quality <input type="checkbox"/> Animal health <input type="checkbox"/> Wise use of resources <input type="checkbox"/> </div> <div> Production/cost efficiency <input type="checkbox"/> Consumer safety <input type="checkbox"/> Animal welfare <input type="checkbox"/> Environmental protection <input type="checkbox"/> </div> <div> Competitiveness <input type="checkbox"/> Animal integrity <input type="checkbox"/> Biodiversity <input type="checkbox"/> Other <input type="checkbox"/> </div> </div> 4. List of concerns that have <i>not</i> been included – and why 5. Statement of key concerns
How are the concerns connected with breeding goals?	6. Clear breeding and reproduction policies relating to each of the key concerns 7. Qualitative or quantitative criteria available between potentially conflicting concerns/criteria
What are the motives and underlying assumptions?	8. Overview of priorities between potentially conflicting concerns/criteria 9. Motivation of stated priorities
How is this communicated to the rest of society?	10. Definitions, breeding goals, selected concerns, identified criteria, ensuing priorities and policies explained (a) within the agricultural community (b) to the rest of society/other stakeholders

Figure 1.

Notice that, as well as requiring concerns to be identified, this checklist also asks what concerns are excluded. In addition, it requires reasons for inclusions and exclusions to be set out. (As mentioned above, many of those in the species groups initially resisted the suggestion that they needed to elaborate their own definitions.) With the checklist in hand, the species groups realised that without a clear statement of included and excluded concerns, it would be difficult to take sustainability any further. In particular it would be hard to formulate directional criteria and to elaborate breeding goals — the topic of the third category of enquiry.

The fourth category of enquiry on the checklist (incorporating questions 8, 9) relates to the *practical* translation of the vision of sustainability conveyed by the included and excluded concerns. An important task at this stage is to make clear the relative priority of different concerns. Each has to be assessed against the others to see if there are potential conflicts between them. For example, productivity may need to be balanced against concern for animal welfare; wise use of resources may need to be balanced against competitiveness. At this stage, one species group stated: “Short-term economic demands must be balanced against long-term sustainable value. A potential problem is the conflict between the requirement of genetic diversity to maximise genetic variability and the automatic effect of selection to increase the frequency of desired alleles, which reduces variability” (Liinamo and Neeteson-van-Nieuwhoven, 2002; 16). Interim statements of this sort are typical at this point in the checklist.

Unsurprisingly, the *weight* attached to individual concerns differed from one species group to another, depending on the species being considered. However, some shared priorities emerged. The maintenance of genetic diversity was prioritised by the ruminant and pig groups. Minimisation of environmental impact and prudent use of feed resources were listed in connection with ruminants, poultry and fish. In aquaculture, where breeding is a relatively new venture, the interbreeding of domesticated stocks and wild conspecifics was considered an important negative environmental impact. Concern for animal welfare and animal health were listed by the ruminant, pig and poultry species groups, but maintenance of animal integrity (i.e. maintenance of normal physiological function) was a specific concern about fish. Production concerns, such as breeding animals which are robust and efficient in different conditions or of an acceptable price, were listed for ruminants, pigs, poultry and fish. Finally, concerns relating to the demand for food safety and product quality, and relatedly consumer acceptability, were highlighted for ruminants, poultry and fish (Liinamo and Neeteson, 2001).

At the end of the networking period, the species groups agreed upon a common definition across the species groups represented: “Sustainability in animal breeding and reproduction means the extent to which animal breeding and reproduction, as managed by professional organisations, contribute to the maintenance and good care of animal genetic resources for future generations”. When they were asked to break down this definition, the group members gave well-presented descriptions of the issues raised by their species, identified and discussed trends, and considered a range of specific problems connected with the future of breeding and reproduction.

5. The Importance of Dialogue

By setting out concerns, their connected criteria, and specific breeding goals in this way, it is possible to present stakeholders in farm animal breeding, and indeed society as a whole, with a detailed picture of sustainable breeding. Stakeholders and other individuals can then see whether they share the values

expressed by a particular breeding goal. By the same token, breeders can adjust their set of concerns, or their priorities — if that is possible and desirable — to accord with a wide constituency of opinion.

If this two-way process of consultation is to be successful, transparency and clear communication of priorities is vital. It might be felt, for example, that animal integrity is not a *key* concern, or that animal integrity is not *as* highly prioritised as consumer safety. And in fact one of the species groups used just this kind of language, stating that “Product quality is a *key issue* of sustainable production. The primary goal of any production is to supply products meeting objective as well as subjective demands of the consumers. Sustainable breeding must be directed toward this goal” (our emphasis) (Lianamo and Neeteson-van Nieuwhoven, 2002; 26). Clear statements of this kind will allow stakeholders to react accordingly.

Fruitful dialogue can, and if necessary should, involve parties with radically divergent starting points. The SEFABAR network’s animal welfare partner, had the job of combing through the work of the species groups and suggesting ways in which animal welfare could, in their view, be more adequately addressed. This partner and the commercial breeders often disagreed, but the network made room for dialogue between industry, scientists and a special interest group, which enabled everyone to go into the arguments a bit more deeply instead of engaging in mud-slinging and painful, unproductive confrontation.

Ideally, stakeholder dialogue will involve a wide range of societal groups, since public perceptions of agriculture and animal breeding and husbandry are in general becoming increasingly influential in decisions about directions for the industry (Christensen, 1998b). In this dialogue, openness about ethical dilemmas and values, and transparency about the ensuing choices and priorities, will play an important role.

5.1 Communication and Management

Questions about dialogue bring out an important distinction between two attitudes to, and hence two ways of capitalising on, sustainability. In practice, these attitudes are really differences in emphasis, but the contrast between them should nevertheless be recognised.

According to the first attitude, sustainability is a *managerial device*. That is, it is a concept under which various breeding goals can be gathered, explained and organised, and its role is to facilitate better management of breeding and reproduction. According to the second attitude, on the other hand, sustainability is a *communication tool*. Breeders and breeding scientists need to engage in discussion with consumers and civil society. The concept of sustainability enables them to present their activities in an understandable and attractive way. It also encourages consumers and other stakeholders to conceptualise their hopes, concerns and expectations in ways that can be readily understood by the breeding industry. (Obviously, in the points made in the last section the emphasis was on the communicative role of sustainability.)

	<i>Sustainability as management device</i>	<i>Sustainability as communication tool</i>
Use	Policies and breeding objectives	Stakeholder communication
Perspective	Mainly breeders	Mostly rest of society
Agenda	Well-defined	Broad
Breeding objectives	Clear	Multi-purpose, unclear
Sustainability concerns	Few and clear Non-conflicting	Many Conflicting
Key issues	Usability Controllability	Accountability Credibility

Table 1. Features of sustainability when viewed as a management device and as a communication tool (Gamborg & Sandøe, 2002).

These rather different roles are associated with a number of contrasts (see Table 1). Thus, when the managerial role of sustainability is emphasised, the focus will be on the *formulation* of breeding objectives. In turn, the very practical nature of the enterprise will ensure that the selection and control of animal characteristics to be promoted is paramount. The concerns and criteria are also relatively few in number, relatively clear and well defined, and relatively non-conflicting.

When the communicative role of sustainability is uppermost, the focus will be on the *presentation* of breeding objectives. Breeders may seek to flag specific issues that are known to be of concern to (say) consumer organisations. They may invoke sustainability in their efforts to show society as a whole that they are aware of these issues. Two of the key requirements will therefore be credibility and accountability to stakeholders — rather than usability and controllability. Again, the range of issues to consider under the sustainability banner here will almost certainly be broad. Connectedly, the concerns, which different parts of society perceive as important, are more likely to be in conflict with each other. It follows that overall breeding objectives may become unclear.

In the long run it is obviously vital that there is a connection between what breeders *do* and what they *say* they want to do. If the two roles of sustainability are best separately addressed, it is equally true that in the end they must be reconciled and combined.

6. Conclusions

The concept of sustainable farm animal breeding can be much more than a marketing ploy or an empty rallying cry of interest groups. If pursued sensibly, it can be a powerful managerial device and a facilitator of communication that opens up stakeholder discussion. However, certain distinctive features of sustainability need to be both recognised and accommodated when a stakeholder approach is used, i.e. when breeders, breeding scientists, interest groups and lay people sit down to discuss sustainable animal breeding. The more important of these features are as follows:

The concept of sustainability is value-laden. Definitions of sustainability will depend heavily on the values and priorities of the person, or group of people, doing the defining. Prominent values defining sustainable farm animal breeding include environmental protection, animal health and disease, animal welfare, animal integrity, biodiversity, consumer safety, food quality, competitiveness, and human welfare.

Consequently, when we try to spell out the practical detail, we find that *there is no single, correct account of the requirements of sustainability*. At its most general — e.g. in the Brundtland commission's famous dictum that sustainable development “meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 8) — the notion of sustainability should be looked upon as an conceptual ‘umbrella’ under which different visions and beliefs, more or less closely connected, shelter. There is no need to reject, or even to be suspicious of, this umbrella. It is just that its implications need to be investigated in the context in which it, so to speak, raised. In this sense, like other economic sectors, the breeding sector needs to *adapt the concept of sustainability* to its, and its stakeholders', specific needs. We have suggested that a productive approach to this is the method of concern-criteria-indicators.

Consequently also, *dilemmas are inherent in sustainability*. It is important to realise that some disagreements as to whether an activity is sustainable will not be resolved on the basis that one party is right and the other wrong. Instead, the resolution will involve, for example, attempts to achieve further clarification of the

values underlying the disagreement and efforts to see how deeply held these values are. It may also involve recognition that the values of one stakeholder group have at least presumed priority over those of another. For example, it might be insisted that livestock farmers are ultimately the servants of society as a whole and hence must bow, to an extent, to societal values.

Finally, it should be borne in mind that *sustainability can be used as an effective tool of communication* and need not be viewed merely as a managerial device. Every stakeholder in the breeding industry, and ultimately society as a whole, has a legitimate interest in the evolving goals and methods of farm animal breeding. So ideally a wide range of stakeholders should be involved in a dialogue about sustainability — a dialogue characterised by openness about ethical dilemmas and values, and transparency about choices. Handled in the right way, the concept of sustainability should help consumers and other non-industry stakeholders to put their concerns to the breeding industry in a clear and effective way. It can also help breeders to present their achievements to a wide audience in a readily understandable form.

Acknowledgements

The help of all the members of the SEFABAR network who provided input to this paper is gratefully acknowledged. We would like to thank two anonymous referees for useful comments. We also want to thank Stine B. Christiansen, who was deeply involved in the early phases of the project. Special thanks go to Lars Gjøl Christensen, Marek Gaworski and Paul Robinson. Financial support through the SEFABAR project EC project number QLG7-CT-2000-01368 is kindly acknowledged.

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